REMARKS/ARGUMENTS

Specification:

Amendments have been made to the specification to correct errors and minor informalities, and to improve readability. No new matter has been added thereby. The following amendments are specifically noted:

Para. [0015]: The common chemical notation "CxFy" is added after "perfluorocarbon gases" consistent with common terminology to establish an antecedent for reference in the claims. The common chemical notation "C_2F_6" is added for hexafluoroethane.

Para. [0021]: "CxFy with y > 6" is added parenthetically after "a higher fluorine content than hexafluoroethane" for which y = 6. The chemical notation c-C_4F_8 is corrected and corrected names for the fluorocarbon cleaning agents octafluoropropane (C_3F_8), cyclic-octafluorobutane (c-C_4F_8) and octafluorotetrahydrofuran (C_4F_8O) re-added, consistent with their disclosure in the version of the same paragraph as originally filed.

Para. [0026]: The notation "std. cm^3/min." is added parenthetically following the first usage of "sccm" for clarity of notation. The third flow rate comparison with the first flow rate is changed from "e.g., about 60 percent less" to "e.g., about 60 percent," for consistency with the fact that a third flow rate of "preferably about 500 sccm" is about 60 percent of (not 60 percent less than) a first flow rate of "preferably about 850 sccm."

Para. [0027]: An obvious error in the lower limit of flow rate for oxygen during the third cleaning step is corrected from "about 100" to "about 1000." The error and its correction are evident from statements in the same and immediately preceding paragraphs (oxygen:fluorocarbon flow rate ratio lower limit of "about 2:1," and preferred fluorocarbon flow rate of "about 500").

Para. [0032]: Recitations of "proximal (face 216a) and distal (edge 216b) sides" of showerhead 215 are added consistent with their illustration in the drawings (see, e.g., FIG. 2 showing of residue 225 on face and edge sides of showerhead 215).

Para. [0034]: The chemical word for C_3F_8 is corrected from "octofloropentane" to "octafluoropropane" and its chemical notation added, consistent with para. [0021], above.

Para. [0038]: The recitation of build-up on "proximal and distal sides" is added, consistent with the illustrated residues 225 and 330 in FIGS. 2 and 3C and the recitations in para. [0032], above.

Drawings:

Replacement formal drawings will be submitted separately, as soon as available, to replace the informal drawings previously submitted herein. The replacement drawings add reference numerals 216a and 216b and associated lead lines in FIG. 2, to respectively indicate the proximal (face) and distal (edge) sides of showerhead 215 (see amendment to para. [0032], above). A marked up copy of FIG. 2 is submitted as part of these Remarks.

Claims:

Claims 1-24 previously presented for examination herein have been cancelled and new Claims 25-64 substituted therefor.

Conventional in situ PECVP chamber-cleaning processes used C_2F_6 in a two-step cleaning process -- a high pressure/high flow rate step to remove residue build-up from showerhead face and edge sides, and a low pressure/low flow rate step to remove residue from the rest of the chamber. Conventional PECVP tools were programmed/settable for the two-step process. Relative durations of the two steps struck a balance for good cleaning effectiveness, minimum gas usage, and minimum downtime between wafer runs.

Perfluorocarbon gases (CxFy) with higher reactivity or fluorine content than C_2F_6 (e.g., C_3F_8, c-C_4F_8, C_4F_8O) do not fit well within the traditional two-step process. If the high pressure/high flow rate step is set a little higher, there can be inadequate cleaning of one of the showerhead face or edge sides; if the high pressure/high flow rate step is set a little lower, there can be inadequate cleaning of the other of the face or edge sides. Breaking the high pressure/high rate step into two steps, one with higher pressure than the other as done in the described example (see Table 1, page 23, of the specification), increases the effectiveness of the cleaning process for removing residue build-up from the showerhead sides.

Claims 25-45 are drawn to an in situ cleaning process for removal of residue build-up from a deposition chamber of a plasma-enhanced chemical vapor deposition tool having multiple showerheads at respective multiple wafer stations. A perfluorocarbon gas CxFy with $y > 6$ is passed through the showerheads into the chamber for a duration at first flow rate, chamber pressure and RF power settings; for a shorter second duration at higher chamber pressure and RF power settings; and for a third duration at substantially lower flow rate and chamber pressure and lower RF power setting. The first, second and third durations occur in any order; and the gas passed at the higher chamber pressure and RF power settings serves to remove residue build-up from sides of the showerheads not removed by the gas passed at the first flow rate, chamber pressure and RF power settings.

Claims 46-54 are drawn, in Jepson format, to an improvement over a, for example, two-step C_2F_6 high pressure/high flow rate and low pressure/low flow rate in situ PECVD chamber-cleaning process in which a fluorocarbon gas is passed through showerheads for a first duration at first flow rate, chamber pressure and RF power settings and for a second duration at second flow rate, chamber pressure and RF power settings; the second flow rate and chamber pressure settings being substantially less than, and the second RF power setting being less than, the first flow rate, chamber pressure and RF power settings; with the gas passed at the first flow rate, chamber pressure and RF settings serving to remove residue build-up from sides of the showerheads; and the gas passed at the second flow rate, chamber pressure and RF settings serving to remove residue build-up from the rest of the chamber. The recited improvement comprises passing the gas for a third duration, shorter than the first duration, with chamber pressure and RF power settings greater the corresponding first chamber pressure and RF power settings; the first, second and third durations occurring in any order; and the gas passed during the third duration serving to remove residue build-up from sides of the showerheads not removed by the gas passed during the first duration.

Claims 55-64 are drawn to a method of manufacturing semiconductor devices wherein wafer transfer, material layer deposition, and wafer removal steps are repeated until deposition residue reaches a given thickness; and then the chamber is cleaned using an in situ cleaning process like that recited in Claim 25.

Accordingly, request is made for withdrawal of the final nature of the action of December 3, 2008, reconsideration of the application as amended hereby, and allowance of the claims as amended.

Respectfully submitted,

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